MINISTRY OF LABOUR

Dust Control in Potteries

FIRST REPORT OF THE JOINT STANDING COMMITTEE FOR THE POTTERY INDUSTRY

LONDON
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1963

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[1] Succeeded Miss K. Crundwell in May, 1959
[2] Succeeded Mr. V. B. Jones in April, 1962
[3] Succeeded Mr. N. Fish in October, 1962

CONTENTS

		Page
	Letter of Presentation	1
Chapters		
1	**Health Hazards in the Pottery Industry**	4
2	**Dust Diseases—Statistical Information**	5
3	**Dust Diseases—Preventive Measures**	11
4	**Summary of Recommendations in Relation to Particular Processes**	15
	Manufacture of Domestic Earthenware and China	15
	Manufacture of Tiles	16
	Manufacture of Sanitary White Ware	16
	Manufacture of Electrical Porcelain	17
	Potters' Mills and Glaze Preparation	17
	APPENDICES	
1	**Dust Extraction Systems in the Pottery Industry** Recommendations prepared by the Joint Standing Committee	18
II	**Suggested Engineering Standards for Dust Extraction Plants** (prepared by a group of Engineers from the Pottery Industry)	25
III	**List of Appliances for the Control of Dust**	28
IV	**Illustration of Suitable Overalls for use in the Pottery Industry**	43
V	**Initial and Periodical Examinations (Specified Processes)** (Schedule to Silicosis and Asbestosis (Medical Arrangements) Scheme, 1931 (as amended), as applied by the Industrial Injuries (Prescribed Diseases) Regulations 1959 (Regulations 41 and 42))	47
BIBLIOGRAPHY		48

FOREWORD

The pottery industry has a long tradition of co-operation in matters of health and safety. More recently, the Joint Standing Committee—which brings together representatives of the British Pottery Manufacturers' Federation, the National Society of Pottery Workers and the British Ceramic Research Association, under the chairmanship of H.M. Superintending Inspector of Factories—has been re-constituted under statutory powers to advise me in these matters. At my request, they have now presented this their First Report, devoted to the problem of dust control in potteries.

I am indebted to the Committee for the thorough review they have made of this problem, for the research which has led to their recommendations, and for the strenuous efforts they have already made to bring these recommendations to the attention of the industry.

I readily accede to the Committee's request for this Report to be published so that the widest publicity may be given to their findings. I commend it to all concerned for study and for action.

JOHN HARE

DUST CONTROL IN POTTERIES

First Report of the Joint Standing Committee for the Pottery Industry.

To: The Rt. Hon. John Hare, O.B.E., M.P.,
Minister of Labour.

Sir,

In 1956, following an approach to the British Pottery Manufacturers' Federation and the National Society of Pottery Workers, the Joint Standing Committee for the Pottery Industry was set up as an advisory body to H.M. Chief Inspector of Factories. This revived a tradition of joint consultation started by the National Council of the Pottery Industry which had considered improvements in health conditions in the industry between 1918 and 1945. The Committee held its first meeting in December 1956 and has since continued to meet at least twice yearly. In October 1960, consequent to legislative changes in the Factories Act 1959, you established the Committee as a statutory body for the purpose of advising you on matters affecting the safety, health and welfare of persons employed in the pottery industry.

In May 1959 you sent to us the report of the Industrial Health Survey of the Pottery Industry in Stoke-on-Trent and requested us to consider what further work was required to deal with the outstanding problems which it disclosed. We considered that the major problem was the control of dust in potters' shops and, associated with that, the control of temperature and ventilation. We therefore appointed a Sub-Committee to study these problems and make recommendations.

This Potters' Shops Sub-Committee first met in June 1959, has met frequently since and has made a number of recommendations which have been published either in cyclostyled or in printed pamphlet form.

In June 1960, the British Ceramic Research Association was invited to join the Committee. The Research Association readily accepted and appointed Mr. A. Dinsdale—the Deputy Director—as its representative; he also agreed to serve on the Potters' Shops Sub-Committee. The Research Association with its special team working on the dust problems of the industry has done, and continues to do, such important work in the field that we consider the closest possible liaison between it and ourselves to be essential for our work. The Research Association had started work on dust control in 1951 and had in fact completed some of it before our Committee was appointed.

The Research Association sponsored a Symposium on Dust Control in the Pottery Industry held in April 1960 and published for circulation among its members some of the valuable papers read at that meeting.

To enable us to assess the seriousness of the dust diseases relative to the various occupations and to arrange a priority programme with regard to dust counts and preventive measures, we carried out an analysis of the cases of pneumoconiosis in the pottery industry diagnosed in Stoke-on-Trent during the period 1950 - 1961 and certified by the Stoke-on-Trent Pneumoconiosis Medical Board. We have also had access to the statistics of the Mass Radiography Unit which, under its Director, Dr. E. Posner, has made two special surveys of the industry since 1952 and is at present engaged on a third.

As the two sets of statistics are collected in different ways and are virtually independent of each other they provide a useful means of confirmation and cross-checking.

We wish to acknowledge our appreciation of the full and ready co-operation we have received from the following—

(a) The British Ceramic Research Association and its Director, Dr. Astbury. This Report

relates to much which the Research Association has done and is doing in the field of dust control and we acknowledge especially the work of Mr. W. A. Bloor and Mr. J. M. Palmer.

(b) The North Staffordshire College of Technology and its Principal, Dr. Patrick; also Dr. German, Head of the College of Ceramics. Conferences and lectures on various aspects of dust control have been held at both Colleges, and training courses for Works Inspectors, appointed under the Pottery (Health and Welfare) Special Regulations 1950, are included in the Curricula of the College of Ceramics.

(c) The Stoke-on-Trent Pneumoconiosis Medical Panel and its senior member, Dr. Coles. The valuable statistical information could not have been made use of by us without the close co-operation which exists between H.M. Factory Inspectorate and the staff of the Panel.

(d) Dr. E. Posner, Medical Director of the Mass Radiography Unit in Stoke-on-Trent.

(e) A number of pottery manufacturers who have either themselves carried out experimental work or who have permitted experiments under working conditions to be carried out in their factories, often at considerable inconvenience and cost to themselves.

(f) The Chemical Branch of H.M. Factory Inspectorate, who carried out some experimental work, particularly on dust sampling, at some of the factories mentioned above.

(g) Mr. N. Fish, H.M. Inspector of Factories, Secretary of this Committee from its inauguration until shortly before this Report was published. His enthusiasm, hard work and detailed knowledge of the industry has greatly assisted the Committee throughout that time. This Report, in all but its final revision, was prepared by him.

In reviewing the dust problem, we have felt that the limited measures so far recommended are not sufficient to control the dangerous concentrations of dust in potters' shops. Some information as to the methods for tackling this problem has been gained from the work done by the British Ceramic Research Association in sanitary ware casting shops, but a detailed knowledge of the problem on which recommendations can be based will only be gained from an intensive programme of dust sampling. We sent to you two memoranda setting out the reasons for such a programme; following subsequent discussion the Research Association increased their dust control investigation branch and embarked on an extensive series of activities.

Discussions have also taken place with the Department of Scientific and Industrial Research (D.S.I.R.) as to the general problem of dust in industry. They have now decided to give urgent consideration to the encouragement of research on health and safety in factories, with particular reference to the problem of mineral dust. In December 1961 a Symposium arranged by the D.S.I.R., in consultation with your Department, was held to discuss the methods of detecting, estimating and supressing dust. This Symposium was attended by, among others, representatives from the research associations of a number of industries where dust presents special hazards. It is hoped that these discussions will help to advance research into the whole problem on a broader front.

The occupational analysis (given in Chapter II, Table IV) shows that there is a serious dust hazard in occupations other than clay shop processes. There is a high incidence of pneumoconiosis among millmen engaged on grinding and crushing flint and stone; among sliphouse workers where, although most of the material is wet, the dry scrap and drying out of contaminated clothing and fittings result in the production of dust; and among biscuit placers in the earthenware section of the industry where it may be desirable to substitute non-siliceous materials for the placing materials now in use, as has been done in the chinaware section.

Much still remains to be done before dust diseases are eliminated from this industry. We think, however, the time has now come to send to you, in accordance with the terms of our appointment, this Report which summarises the work we have done and the recommendations we have

made on dust control during the first five years of our existence. We hope that you may see fit to publish this our First Report so that the widest possible publicity can be given to our findings and, more important still, that the industry should accept and put into practice the measures which we recommend.

We have the honour to be, Sir,

Your obedient Servants,

Signed M. BRAND (*Chairman*)
J. E. CLOWES
E. R. G. CORN
J. M. W. DAVIS
A. DINSDALE
A. DULSON
H. HEWITT
S. HOBSON
L. JACKSON
R. BASIL JOHNSON
A. J. LEWIS
L. A. PITTOM
D. P. SHELLEY
W. TRANTER
NORMAN WILSON
P. H. ROYLE (*Secretary*)

13*th November*, 1962.

CHAPTER I

Health Hazards in the Pottery Industry

1. The pottery industry's otherwise attractive reputation has always been somewhat marred by its need to use toxic and hazardous materials with consequent ill effects on the health of its workers. In recent years safer substitutes have been found for some dangerous materials but others are still in daily use.

2. Lead poisoning was the dominant risk until well into this century but, although lead is still widely used, effective measures have now been taken to control its risks and, by 1947 when regulations were introduced prohibiting the use of raw lead glazes, the disease had been virtually eliminated. Silicosis, or pneumoconiosis as it is now called, is still prevalent and is now the principal health hazard in the industry.

3. A special Industrial Health Survey of the industry was carried out by members of H.M. Factory Inspectorate in the Stoke-on-Trent district during the period 1956 to 1958. The report of this Survey (published in 1959) contains a full description of the pottery industry, its structure, processes and numbers employed in the various sections, and therefore such details have not been given again in this Report.

4. The Industrial Health Survey Report again emphasised the need for further measures to be taken to reduce the dust hazard in the potteries and much of the work of the Committee has been concerned with assessing the dust risks in various processes and sections of the industry, and devising methods of reducing or controlling the fine dust which may cause serious damage to the worker's lungs if inhaled over long periods.

5. The fact that many workers in the pottery industry suffered from lung diseases had been known from early times. It had also earlier been accepted that while flint dust was the most serious risk, clay dust was also a cause of disease. The Special Rules of 1894 introduced exhaust fans for the towing of earthenware; those of 1898 introduced a similar provision for china scouring. The Departmental Committee which reported in 1910 recommended " measures for the removal of dust, for good general ventilation and for securing a reasonable temperature in the workrooms as will be best calculated to minimise the risk of injury to the lungs". These recommendations were embodied in the 1913 Code of Regulations. It is interesting to find that the 1910 Committee gave consideration to the question of recommending a maximum amount of dust permissible in the air and they advised that H.M. Factory Inspectors or other competent observers should continue to take samples of dust systematically.

6. In 1933 the Pottery (Silicosis) Regulations were introduced to deal more stringently with the dust risk in the industry generally and particularly in potters' shops. The most striking progress was made in the china section of the industry by the change over from flint to alumina for china biscuit placing. In 1947 the Pottery (Health) Special Regulations were introduced which prohibited the use of raw lead glazes and the use of flint for china biscuit placing and for a number of other uses, such as saggar wash, polishing, etc.; they also required flint for the body to be brought into the factory only in the form of a slop or paste. In 1950 the Pottery (Health and Welfare) Special Regulations were introduced which replaced the 1913 and 1933 Regulations. These strengthened the control over dusty processes, required the provision of impervious floors, a higher standard of cleanliness and better control of temperature and general ventilation in clay shops.

7. Pneumoconiosis is not a notifiable disease under the Factories Act but workers in the industry who suffer from it are entitled to disablement benefit under the National Insurance (Industrial

Injuries) Act and sufficient information is available in the records of the Ministry of Pensions and National Insurance to provide a basis on which to assess the relative incidence of the disease in the various occupations. This information is set out in the following pages. Information about the number of cases occuring is also available in the reports of the Stoke-on-Trent Mass Radiography Unit. During the periods 1952 - 1954 and 1955 - 1958, Dr. E. Posner, the Medical Director of the Unit, carried out special surveys of the pottery industry during which 73.2% of the working population submitted themselves for X-ray examination. His findings confirmed the belief that the disease was widespread amongst workers employed in certain well-defined processes.

CHAPTER II

Dust Diseases - Statistical Information

8. Owing to the heavy concentration of pottery in the Stoke-on-Trent area and the resultant lack of mobility compared with, say, the foundry industry, there is now more reliable statistical information available about the incidence of dust diseases amongst pottery workers than in any industry other than mining.

9. It will be seen from Table II that over 2,000 persons in North Staffordshire who are, or who have been, employed in the pottery industry have been assessed as disabled by pneumoconiosis and are at present in receipt of benefits under the National Insurance (Industrial Injuries) Act scheme.

10. The fact that some persons have worked in several occupations is an unavoidable difficulty in relating cases of disease accurately to occupation. This difficulty is appreciably less for pottery than for some industries since most skilled pottery craftsmen stay all their lives in one occupation and usually in the same branch of the industry. It has been possible to find a substantial number of workers who are suffering from a dust disease which can be clearly attributed to their particular occupation and this enables useful comparisons to be made of the relative incidence of the disease in the various occupations (see Table IV).

11. Dust diseases generally develop very slowly and only after some years of exposure to dust. The occupational analysis of cases diagnosed today relates in the main to working conditions over a long period and does not give a direct measure of the present distribution of risk in the industry. Nor, for this reason, can it indicate the immediate effectiveness or otherwise of any sharp change in techniques or dust control methods, e.g. the substitution of a safer for a more dangerous material, or the installation of a better designed exhaust hood for some patticular process. To obtain this information, figures for the cases diagnosed have to be supplemented by dust estimations and a knowledge of how working conditions have changed.

12. Where, however, changes have been more gradual, so that conditions 15 to 20 years ago were not radically different from the present (and this appears to be the case over large sections of the pottery industry), it may reasonably be assumed that new cases diagnosed give some guide as to the present distribution of the risk.

13. Persons employed in any patt of the pottery industry may claim benefit for pneumoconiosis under the National Insurance (Industrial Injuries) Act; diagnosis for determining entitlement to disablement benefit is undertaken by the Pneumoconiosis Medical Board. If the claimant is found to have pneumoconiosis, or pneumoconiosis accompanied by tuberculosis, the Board will assess the degree of disablement resulting from the disease. This is expressed as a percentage and is made by a comparison of the claimant's condition as a result of the disease with the condition of a normal healthy person of the same age and sex. This assessment is given for a period of one to three years; at the end of that time the claimant is re-examined and a fresh assessment made.

14. In addition to the process of diagnosis, assessment and re-assessment, and in principle quite distinct from it, the Pneumoconiosis Medical Panels operate a scheme of compulsory initial and periodic medical examination of workpeople employed in certain specified occupations (see Appendix V). This system of regular medical examination was started under the earlier Workmen's Compensation Silicosis Scheme. Priorities which arose with the introduction of the Industrial Injuries Act in 1948 delayed the periodic examinations and the scheme did not get into full operation again until 1954. In 1957 the Stoke-on-Trent Panel had completed rather more than a full " cycle " of examinations. They are now examining all persons employed in the specified occupations about once in every two years.

15. Table I has been extracted from the Annual Reports of the Ministry of Pensions and National Insurance; the figures relate to those cases where the pottery industry is the probable attributable industry.

TABLE I

The numbers of pottery cases first diagnosed by all the Pneumoconiosis Medical Boards under the National Insurance (Industrial Injuries) Scheme

Year	Applicants for Benefit examined or re-examined (not previously diagnosed)	New cases diagnosed	Percentage of applicants diagnosed
1950	153	128	84
1951	178	135	76
1952	204	153	75
1953	392	354	90
1954	406	345	85
1955	406	382	94
1956	466	432	93
1957	292	233	80
1958	344	259	75
1959	176	89	51
1960	111	50	45
	3,128	2,560	

16. When considering these statistics it should be remembered that in the 1939 - 1945 war period the industry was concentrated into a small number of factories and the numbers employed fell from 67,000 in June 1939, to 36,200 in June 1944. The removal from the industry of over 30,000 workers (of whom at least 20,000 would be exposed to the risk of pneumoconiosis) for a period of several years will have affected the incidence of the disease during and after the war period. The industry did not return to its pre-war strength until 1948. On the other hand a substantial back-log of undetected cases had accrued prior to 1950, many of which would be first diagnosed in the 1950 - 1958 period and would inflate the figures for those years. In particular the upsurge of new cases between 1953 and 1956 and the reduction following that date may be partly due to the comprehensive X-ray campaign in the industry during that period resulting in earlier and more accurate diagnosis.

17. Table II relates to examinations made by the Stoke-on-Trent Pneumoconiosis Medical Board under the National Insurance (Industrial Injuries) Act; under that Act every person certified by the Board to be suffering some degree of disablement is seen by the Panel doctors at least once in every three years for re-examination and re-assessment. In addition to the 2,062 workers

certified by this Medical Board some 200 others were in receipt of allowances under the Pneumoconiosis and Byssinosis Benefit Scheme and other persons are undoubtedly still receiving compensation under the old Workmen's Compensation Scheme but no statistics are available regarding them.

TABLE II

Analysis by age and degree of disablement of pottery workers suffering from pneumoconiosis examined by the Stoke-on-Trent Pneumoconiosis Medical Board 1958 - 1960

Percentage Disablement	Age							Totals of Groups	Cum. Totals
	Under 31	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81+		
100	—	1	16	27	31	5	—	80	—
90	—	—	—	2	1	—	—	3	83
80	—	1	2	8	8	9	—	28	111
70	—	—	3	10	21	3	—	37	148
60	—	1	2	25	42	6	—	76	224
50	—	—	4	29	52	20	—	105	329
40	—	1	9	63	84	13	—	170	499
30	—	1	23	89	87	19	—	219	718
20	—	—	67	186	141	23	1	418	1,136
10	1	62	261	410	174	18	—	926	2,062
Totals	1	67	387	849	641	116	1	2,062	
Cumulative Totals		68	455	1,304	1,945	2,061	2,062	—	

18. Table III relates only to cases where death was caused or materially accelerated by pneumoconiosis and death benefit was paid under the National Insurance (Industrial Injuries) Act. Not all pneumoconiosis deaths give rise to claims for death benefit. In addition there would be some deaths due to the disease where benefit would be paid under the Workmen's Compensation and Pneumoconiosis and Byssinosis Benefit Schemes. The number of these deaths among pottery workers is not known but is probably in the region of 10 to 15 per year.

TABLE III

Analysis by Age and Year of Death of Pottery Workers in the Stoke-on-Trent area [(a)] *whose death resulted from pneumoconiosis* 1950 - 1959

Age	Year of Death										Totals
	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	
35–39			1	1			1				3
40–44			1	1	3	1			2	1	9
45–49		2	5	3	7	3			3		23
50–54	2	2	1	3	5	2	2	4	5	4	30
55–59	5	4	5	6	3	4	5	8	6	4	50
60–64	4	6	4	7	8	10	7	10	6	10	72
65–69	1	2	2	7	5	10	11	9	3	7	57
70–74			5	2		2	4	3	1	3	20
75–79				1							1
Totals–all ages	12	16	24	31	31	32	30	34	26	29	265

(a) Staffordshire, Warwickshire, Worcestershire, Shropshire and Herefordshire.

19. H.M. Factory Inspectorate in the Stoke District have examined the working histories of pottery cases diagnosed by the Stoke-on-Trent Pneumoconiosis Medical Board during the period 1950 - 1961. Many persons have worked in so many different occupations during the course of their working lives that in their cases the occurrence of the disease cannot be attributed to a particular occupation. Nevertheless, out of a total of 2,015 case histories examined, it was found that 1,422 workers had remained in the same occupation and in the same section of the industry for at least five-sixths of their working life. These workers had not been exposed to a serious dust risk in any other secondary occupation and, therefore, the disease was clearly attributable to their particular occupation.

20. An analysis of so large a sample of the cases occurring in the industry provides a sound basis for assessing and comparing the relative dangers from dust in the various pottery processes. It also provides a valuable guide in assessing the priorities to be accorded in dealing with the many complex problems with which the Committee is faced.

21. The results of this analysis are shown in Table IV. The percentages shown in the table are based on the number of workers employed in the processes in June 1961, when a census was taken of all persons employed in the industry in the Stoke-on-Trent district. During the period under review there have been no fluctuations in the relative numbers employed in the various processes which would affect significantly the comparison, excepting in two occupations which have declined substantially—throwing and turning. This decline of the working population exaggerates the percentage figures, for the backlog of old cases is being expressed as a percentage of the few workers remaining in the industry.

22. It should also be borne in mind that the omission from the statistics of cases with mixed occupations will reduce the percentages in those sections of the industry where there is much unskilled labour and a large labour turnover, such as potters' milling and the dust preparation departments of the tile industry. It will not affect the skilled occupations, such as " making ", " casting " and " glazing ", to any significant degree.

23. It will be seen from the analysis that the occupation producing the largest number of cases is clay shop work and it is with conditions in these shops (known as potters' shops) that the Committee has been particularly concerned. Much has already been done to improve conditions in some of the other occupations and in these a substantial reduction (or even complete elimination) in the number of cases occurring, can be expected. For example, the substitution of alumina for powdered flint in the process of placing china biscuit ware for the firing should eventually eliminate the disease amongst china biscuit placers.

24. Substitution of safer materials should also remove the risk from the process of glost polishing. Most of the cases which have occurred in the glost warehouses have been amongst men who were employed in this occupation at the time when powdered flint was used as a polishing material. This material has been prohibited since 1947.

25. In earthenware sliphouses the substitution of slop-flint for dry flint has undoubtedly reduced the incidence amongst men in this occupation. It will be noted that the relative incidence is now higher in the *china* sliphouse where no flint is normally handled but where powdered Cornish stone containing 30% - 35% free silica is still handled in the dry state.

26. In the dust preparation section of the tile industry improved methods of drying clay and mechanical handling of the clay-cake and the clay dust should also bring about a considerable improvement in the dust conditions.

27. For most of the occupations the relative incidence of the disease is roughly consistent with the known periods of exposure and the concentrations of dust found in the various occupations, but this is not so for those engaged in the casting of ware. As will be seen from the table the incidence amongst earthenware " makers " is nearly three times greater than amongst earthenware " casters and fettlers " and for the bone-china clay shops the difference is even greater—for male makers the incidence is eighteen times greater than for male casters. This suggests that further research work into the effects of different types of pottery dusts on the lungs might produce results that could lead to more effective methods of prevention than are at present available.

TABLE IV

Occupational Analysis

(i) *Cases diagnosed by Stoke-on-Trent Pneumoconiosis Medical Board during the period* 1950 - 1961

	Number of new cases diagnosed			Number of cases expressed as a percentage of the workers employed in the processes in June 1961		
	Men	Women	Total	Men	Women	Total
1. Milling and Glaze Preparation	40	—	40	6.0	—	6.0
2. Sliphouses: (a) Earthenware	16	—	16	4.8	—	4.8
(b) China	7	—	7	7.9	—	7.9
(c) Other	5	—	5	1.3	—	1.3
3. Dust Preparation	11	1	12	5.0	6.7	5.1
4. Clay Shops (see detailed analysis in Table IV (ii))	349	436	785	9.0	5.3	6.4
5. Biscuit Placing: (a) Earthenware	33	—	33	8.5	—	8.5
(b) China	38	—	38	21.1	—	21.1
(c) Other	17	—	17	7.3	—	7.3
6. Biscuit Warehouse	7	35	42	1.2	1.9	1.7
7. Glazing and Glost Placing	60	7	67	2.8	0.3	1.6
8. Glost Warehouse (including Glost Polishers) ...	25	3	28	1.4	0.1	0.5
9. Decorating	—	—	—	—	—	—
10. Miscellaneous occupations (Labourers, saggar makers, etc.)	50	—	50	0.7	—	0.7
11. Mixed occupations within the pottery industry ...	—	—	282	—	—	—
Totals	658	482	1,422	3.7	1.8	3.2
12. Mixed industries, e.g. pottery and mining ...	—	—	593	—	—	—
	—	—	2,015	—	—	4.6

(ii) *Detail of Clay Shops*

	Number of new cases diagnosed			Number of cases expressed as a percentage of the workers employed in the processes in June 1961		
	Men	Women	Total	Men	Women	Total
Clay Shops:						
(a) Sanitary earthenware	94	2	96	21.1	3.7	19.3
(b) Sanitary fireclay	7	—	7	5.7	—	5.7
(c) Tiles (Press shops only)	9	95	104	5.2	9.6	9.0
(d) Earthenware } see detailed analysis in Table IV (iii)	164	307	471	8.3	6.6	7.2
(e) China } see detailed analysis in Table IV (iii)	65	21	86	9.1	1.7	4.4
(f) Electrical Porcelain	10	11	21	2.6	1.0	1.3
	349	436	785	9.0	5.3	6.4

	Number of new cases diagnosed			Number of cases expressed as a percentage of the workers employed in the processes in June 1961		
	Men	Women	Total	Men	Women	Total
(d) Earthenware Clay Shops						
1. Throwers and Assistants	6	—	6	15.4	—	9.1
2. Makers	111	88	199	14.0	18.0	15.5
3. Casters and Fettlers	19	89	108	5.8	5.3	5.4
4. Turners and Assistants	5	—	5	4.8	—	3.9
5. Other Clay Shop Workers	23	72	95	3.3	3.7	3.6
6. Towers	—	58	58	—	12.6	12.6
	164	307	471	8.3	6.6	7.2
(e) China Clay Shops						
1. Throwers and Assistants	15	5	20	38.0	13.9	26.6
2. Makers	21	3	24	9.2	6.5	8.8
3. Casters and Fettlers	1	2	3	0.5	0.4	0.4
4. Turners and Assistants	19	3	22	21.6	5.7	15.6
5. Other Clay Shop Workers	9	8	17	5.6	1.5	2.4
	65	21	86	9.1	1.7	4.4

28. In post-war years more cases of pneumoconiosis have been diagnosed by the Pneumoconiosis Medical Panels than in the past. This does not, however, necessarily mean that the industry is becoming more dangerous; it may be explained by more awareness of the risk leading to better detection, both of " live " and " dead " cases. The radiographic techniques used in the pre-war period were quite different from modern techniques; workers were selected in a different way and investigations were carried out at a time when the scientific and legal connotations of pneumoconiosis were, in important aspects, quite different from now.

29. Short-period rises and falls in the number of cases diagnosed are of little significance. The figures for 1950 - 1960 which have been examined are almost certainly swollen by the backlog of cases which have been brought to light by the Mass Radiography Unit surveys in 1952 - 1958 and by the re-institution of systematic period examinations by the Pneumoconiosis Medical Panel in 1955.

30. The figures indicate fairly certainly that the present pneumoconiosis cases are not simply a heritage from bad conditions in the past. The fact that new cases are emerging with five to 20 years' exposure is one indication of this. There appears to be little doubt that conditions as they exist in potteries today are causing pneumoconiosis, and will continue to cause it unless additional preventive measures are adopted. Even in typical modern factories, dust samples confirm the presence of dust concentrations sufficient to create a hazard for some of the workers.

CHAPTER III

Dust Diseases - Preventive Measures

31. Potters' pneumoconiosis is caused by the inhalation of dust containing silica, and will continue to occur unless measures are taken to free the air of the workroom of dangerous dust. There is no record of a worker in the industry who had acquired the disease and had not been exposed to a

known dust risk. For example, although there are about 10,000 workers employed on the decoration of ware in the Stoke-on-Trent potteries—a process where there is no known dust risk—there is no recorded case of pneumoconiosis amongst them. In the long run new production techniques may entirely separate the worker from the dusty processes, or methods may be found for making pottery without creating dangerous dust, but until such radical changes have taken place, every effort must be made to design, install and maintain dust control appliances which will give the maximum degree of protection.

32. The Committee has, therefore, made recommendations aimed at encouraging the industry to adopt preventive measures, which may be grouped as follows—

(i) the installation and regular maintenance by competent persons of dust control appliances of the highest standard to control dust given off at the known dust-producing processes such as towing, fettling, etc.;

(ii) the installation of mechanical ventilation systems to improve the general ventilation of shops in which there are secondary sources of dust which cannot, at present, be either eliminated or controlled by the appliances mentioned at (i);

(iii) the provision of protective clothing of a type which research has shown to have dust resistant qualities superior to cotton clothing; and

(iv) the careful selection and training of persons to be appointed as Works Inspectors under the Pottery (Health & Welfare) Special Regulations 1950.

Dust Control Appliances

33. A pamphlet 'Dust Extraction Systems in the Pottery Industry' has been prepared by the Committee (see Bibliography). This pamphlet, whose contents are reproduced in Appendix I, sets out basic principles for the guidance of manufacturers and engineers responsible for the installation and maintenance of dust control equipment. It was published in August 1958 as one of the Committee's earliest tasks because, while the provision of good localised exhaust was recognised as vital, many of the systems installed were found to be faulty in design and layout. The pamphlet emphasises especially the importance of enclosure at the point of origin of the dust, the value of as much as possible of the system that is within the workroom being under negative pressure and the importance of correct siting of the collecting apparatus to prevent the dust returning to an occupied room.

34. Special processes such as fettling and towing have been the subject of investigations by the British Ceramic Research Association. These investigations showed that appliances previously used were far from satisfactory. The Research Association were able to design improved appliances which were fully effective and to set out specifications for these which were submitted to H.M. Chief Inspector of Factories and accepted by him as providing means of practical compliance with the legal requirements. Up to the present time the Research Association have designed appliances for controlling the dust at seven special processes. A list of these is given in Appendix III.

General Ventilation

35. The work described above has placed the emphasis on localised exhaust, that is, the application of an exhaust draught at the point where the dust is generated and its removal to a safe place by means of ducting and collecting units. Dust may also be reduced by the provision of a good system of general ventilation. In certain circumstances it may be necessary to employ both methods in the same workroom, and further researches in the control of background dust may point to the importance of an increase in general ventilation to remove the dust laden atmosphere.

Protective Clothing

36. It is the dust carried in the air in the breathing zone of the worker which has the greatest effect on his health, and experiments have shown that when protective clothing of certain design and materials was worn, significant reductions could be brought about in the concentrations of that dust. The usual type of protective clothing worn in the past was a cotton drill overall and, in certain processes, a rubber or plastic apron. Experiments by the British Ceramic Research Association showed that, for those working in dusty processes and also for those handling plastic or wet clay—which dried out and so became dusty—the cotton overall retained and gave off dust which remained in the breathing zone and also contributed significantly to the dust in the general atmosphere.

37. Following co-operation between the pottery manufacturers who carried out trials and the Research Association who made laboratory tests of a wide range of fabrics, it was possible to select particular fabrics and to recommend these to the industry, together with designs for the overall itself, which would eliminate or at least reduce the dust from this source.

38. All Terylene filament fabrics tested by the Research Association had a very low dust pick-up but differed in their resistance to dust penetration and their permeability to air. The ideal fabric should have a high resistance to the passage of dust and a low resistance to the passage of air; in practice it is necessary to strike a balance and to accept a fabric which has a high resistance to dust but will " breathe " sufficiently to be comfortable in wear. A list of suitable tested fabrics was circulated with the Committee's recommendations.

39. In the design of the garment the aim was to achieve a plain front without pockets, button-holes or other features which retain dust. Illustrations of suggested designs are reproduced in Appendix IV. It is necessary that the garment should completely cover all parts of the worker's own clothing which might be exposed to clay or dust, it should be comfortable to wear and easy to launder and maintain. The recommended designs have met all these requirements and proved themselves satisfactory in wear.

40. In November 1961 it was therefore recommended that all pottery manufacturers should, as soon as possible, introduce Terylene protective clothing for all workers engaged in processes where pneumoconiosis is known to occur. These processes are (i) milling, (ii) sliphouse work and dust preparation, (iii) all processes in clay shops, casting shops and press shops (including the carrying of clay), (iv) earthenware biscuit placing and brushing, (v) application of glaze and ware cleaning, (vi) glost placing. In general a good start has been made in the provision of Terylene protective clothing.

Works Inspectors

41. The Committee has tried to encourage manufacturers to give more careful consideration to the selection and training of persons appointed, as required by the Pottery (Health & Welfare) Special Regulations 1950, to carry out a systematic inspection of the works and to record their findings daily. The person so appointed has become known as the Works Inspector. His task is not an easy one. He has to have knowledge of the Pottery Regulations, as well as of the industry, he has to have time to give to the work, he has to be observant, he has to have some authority and he has to have tact in the use which he makes of this authority.

42. It was decided that attendance at a training course for Works Inspectors would enable the man appointed to know better the work that he was required to do and would also help the manufacturer to appoint the right man and give him the necessary authority when appointed. The College of Ceramics readily agreed to arrange training courses. Several successful courses have been held and the courses will continue as a regular part of the College curriculum so long

as the demand for places justifies them. Diplomas are awarded to those who successfully complete these courses and there is already evidence that these trained Inspectors are raising the standard of compliance with the Regulations in the factories where they work.

43. As an aid to these Works Inspectors and to others who have to be familiar with the Pottery Regulations, the Committee prepared a guide known as 'An A.B.C. Guide to the Pottery Regulations' (see Bibliography) which sets out to summarise under headings, and so simplify for quick reference, the requirements of the full Code which are necessarily complicated and elaborate.

Action taken by the Committee

44. The following is a summary of the action taken by the Committee to further these recommendations:—

(i) a pamphlet entitled 'Dust Extraction Systems in the Pottery Industry' has been produced (see Bibliography and Appendix I);

(ii) a report embodying suggested engineering standards for dust exhaust systems, drawn up at the request of the Potters' Shops Sub-Committee by a group of pottery engineers of Stoke who hold occasional meetings to discuss their common problems, has been circulated to all pottery manufacturers (see Appendix II);

(iii) drawings and specifications of efficient appliances for the control of dust designed by the British Ceramic Research Association have been circulated to all pottery manufacturers (see Appendix III);

(iv) recommendations regarding suitable materials and designs for protective clothing have been circulated to all pottery manufacturers (see Appendix IV);

(v) information has been circulated to all pottery manufacturers about an air flow instrument developed by the British Ceramic Research Association as a rapid means of checking the air flow at exhaust hoods (see Appendix I, para. 17);

(vi) recommendations incorporating the findings of the Potters' Shops Sub-Committee concerning improvements of conditions in potters' shops have been circulated to all pottery manufacturers: these emphasised

(a) that the design, layout and maintenance of all dust control systems should be of the highest standard;

(b) that periodic examination of such systems should be carried out at least once in every six months;

(c) that such periodic examinations should be made preferably by independent persons and only those fully competent to do the work;

(d) that a routine inspection of the dust control plant should be made weekly;

(e) that suitable instruments to measure air velocity should be provided for the use of these weekly inspections;

(vii) advice has been circulated to all sanitary ware manufacturers as to the control of dust in sanitary white ware casting shops (this advice is summarised in Chapter 4);

(viii) a pamphlet entitled 'An A.B.C. Guide to the Pottery Regulations' has been produced (see Bibliography).

General Publicity

45. The Committee has also recognised the need to develop a wider and more active interest in the problems of dust suppression and control amongst workpeople, management, ventilating engineers and others connected with the pottery industry, and has recommended that lectures

and films designed to attract a wide audience should be arranged. With the co-operation of the College of Ceramics, public meetings have been held and a series of lectures given which attracted large audiences.

CHAPTER IV

Summary of Recommendations in Relation to Particular Processes

46. For the convenience of the reader interested only in one section of the industry the recommendations applicable to each section and the practical measures required to carry them out are summarised in this chapter.

Manufacture of Domestic Earthenware and China

Towing of Flatware

47. The exhaust hood as designed by the British Ceramic Research Association should be used (see Appendix III A).

48. The specification for this hood was drawn up in 1955. It is now in use in most potteries in the Stoke-on-Trent district and no special difficulties have been encountered.

Fettling of Cast Ware and other Hollow-ware

49. The exhaust hood as designed by the British Ceramic Research Association should be used for all hollow-ware fettling processes (see Appendix III B).

50. The specification was drawn up in 1956. Considerable progress has been made in the provision of these hoods especially in the earthenware casting shops.

51. Attention should be given to layout and the method of handling the ware to and from the hood to encourage the worker always to work with the ware inside the hood while fettling. Good local lighting is necessary and the hood should be positioned to avoid reflected glare. Neglect of these considerations has caused difficulties with the use of the hood when it has been first introduced.

52. The hood is equally effective when constructed with the side opening to the right and the exhaust at the left, and this layout may be more convenient for a right-handed worker.

53. To accommodate large articles, such as vases, it has sometimes been found necessary to increase the dimensions of the hood, but care should be taken to maintain the relative position of the glass screen so that the fettler stands comfortably with the screen between the ware and her face. The dimensions should not be altered without consultation with the Research Association.

Cup Turning

54. A dust control appliance as designed by the British Ceramic Research Association should be fitted to " Malkin " cup turning machines (see Appendix III C).

' Sorting ' by Pneumatic Chisel

55. The appliance of controlling dust at the process of "sorting" ware by pneumatic chisel, as designed by the British Ceramic Research Association, should be used.

Protective Clothing

56. Suitable Terylene protective clothing should be provided for all workers engaged in processes where they are exposed to dust or damp clay.

Details of this clothing and a list of the recommended processes are given in paragraphs 36 to 40.

Fettling of Tiles

57. The exhaust hood designed by the British Ceramic Research Association specially for the fettling of tiles should be used (see Appendix III D).

58. This hood is similar in principle to that designed for the fettling of hollow-ware. Very little difficulty has been experienced by the workers in using it. Most of the points mentioned in paragraphs 49 to 53 will also be relevant to its installation.

Pressing of Tiles: Semi-automatic Friction Screw Presses

59. The device designed by the British Ceramic Research Association which effectively controls the dust given off at the dies of these presses should be installed (see Appendix III E).

60. The front screen of this appliance is interlocked with the driving mechanism of the press so that the screen must be in the closed position before the press can be operated. The appliance therefore also serves as a safety device to prevent access to the trapping area between the dies when the press is in motion. These interlocking mechanisms are available for the three types of presses in common use in the pottery industry, and the devices have been accepted by the Factory Inspectorate as providing a satisfactory method of securing compliance with section 14 of the Factories Act and regulation 17 of the Pottery (Health & Welfare) Special Regulations 1950; the Committee recommend their adoption for controlling the dust at all these presses.

Pressing of Tiles: Automatic Tile Presses

61. The British Ceramic Research Association with the press makers have designed an efficient appliance to improve the methods of dust collection and control at the Collingham and Owen presses. The Committee recommend the provision of this or an equally efficient appliance (see Appendix III F).

Protective Clothing

62. Suitable Terylene protective clothing should be provided for all workers engaged in processes where they are exposed to dust or damp clay.

63. Details of this clothing and a list of the recommended processes are given in paragraphs 36 to 40.

Manufacture of Sanitary White Ware

Fettling

64. A suitable exhaust hood, such as that designed by the British Ceramic Research Association, should be provided and used for all fettling which gives rise to dust (see Appendix III G).

Protective Clothing

65. Suitable Terylene protective clothing should be provided for all workers engaged in processes where they are exposed to dust or damp clay.

66. Details of this clothing and a list of the recommended processes are given in paragraphs 36 to 40.

General Ventilation

67. A good system of general ventilation by mechanical means should be provided in all sanitary casting shops. Such a system would give better control of dust than natural ventilation and is necessary to reduce the dust concentration to an acceptable level—below 40 particles per c.c.—as there is much dust which cannot be controlled by localised exhaust ventilation. Natural forces

alone will not control the movement of large volumes of air and distribute it satisfactorily to all working places. Experiments in three different sanitary casting shops have shown that not less than 750 cubic feet per minute for each sanitary caster should be introduced into the shop. A combined supply and exhaust system is to be preferred with the supply slightly exceeding the exhaust in order to maintain a slight pressure in the shop.

68. The manner in which the air is supplied and exhausted depends on the method of drying the ware and on the size and shape of the shop. The following points are important:—

(i) the incoming air should be mixed with the air in the shop as thoroughly and rapidly as possible; it is therefore desirable that there should be several widely distributed air inlets;

(ii) the incoming air should be introduced in such a way as to avoid objectionable draughts;

(iii) short circuiting to or from nearby windows or doors or other openings should be avoided;

(iv) in most cases provision will have to be made for heating the incoming air and it is preferable that the temperature should be thermostatically, rather than manually, controlled.

69. Care must be taken in the arrangement of the ventilating system so that the flow of heated air is not directed towards the casters as this may blow dust from the moulds and stillages towards them. The temperature of the heated air must also be carefully controlled to prevent the temperature in the shop rising to a level which will make the wearing of Terylene clothing uncomfortably hot. Experience suggests that for this purpose temperatures should be kept below 70°F., although the legally permissible maximum is 75°F.

Manufacture of Electrical Porcelain

Fettling

70. The hoods designed by the British Ceramic Research Association for fettling either tiles or hollow-ware may be used for the fettling of articles of electrical porcelain but the British Electro-Ceramics Manufacturers Association has approached the Research Association and asked them to design a hood specially for electrical porcelain fettling. The Research Association is at present investigating this problem. The Committee hope to make recommendations when this work is completed.

Protective Clothing

71. Suitable Terylene protective clothing should be provided for all workers engaged in processes where they are exposed to dust or damp clay.

72. Details of this clothing and a list of the recommended processes are given in paragraphs 36 to 40.

Potters' Mills and Glaze Preparation

73. The Committee recommend that suitable Terylene protective clothing should be provided for all workers employed in this section of the industry.

74. Other recommendations for improving conditions are still under consideration.

APPENDIX I

Dust Extraction Systems in the Pottery Industry

Recommendations prepared by the Joint Standing Committee

The application of exhaust draught to the source of dust

1. In order to make the exhaust draught effective, the point of origin of the dust should be enclosed so far as practicable. This is usually done by some form of hood, but dust extraction will be efficient only if each type of hood is designed for the particular process or machine, so that there is the maximum control of dust and the minimum interference with production.

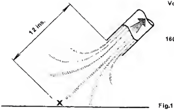
2. The simplest general problem of dust control can be explained if we take a steady flow of dust from a small source. If this dust is to be prevented from entering the air of the workroom by exhaust ventilation, we have to ensure that the air at and immediately around the source of the dust is flowing steadily, completely and reliably into the dust extractor: in other words, what matters is direction and linear velocity of flow at the point of origin of the dust and these will vary according to the extent and design of the enclosure provided at the dust source.

3. For example, if there is a suction opening (e.g. the open end of an extraction duct) in free still air, the velocity of air movement towards it varies inversely with the square of the distance from the opening. If, therefore, the suction opening is more than a very few inches from the dust source, a very high air-speed will be needed in the ducting to cause quite a slow movement at the dust source; further, quite a small cross-draught say, from an open window, may counteract this air movement altogether and make the whole system ineffective. If, however, the source of dust is enclosed, whether by the structure of the plant or by a special hood, it will be possible to obtain a higher air speed at the source of dust with a lower rate of extraction at the fan—a desirable economy. Moreover, a system that is efficient in this respect is likely to be more reliable, since it will be less vulnerable to outside draughts; it will also be less of a drain on the heating of the workrooms in cold weather, since less air is extracted.

4. These points are illustrated in Figures 1, 2 and 3. In each case the source of dust is shown as (X) and exhaust is applied by a duct 12 inches away. Figure 1 shows an arrangement by which exhaust is applied simply by a small duct opening or " fish-tail " 12 inches away from the source of dust. With such an arrangement it is almost impossible to forecast the air movement at (X) with any certainty. To achieve a probable air movement of 150 feet per minute at (X) (and speed would not give reliable dust extraction, since it would be negatived by normal cross-draughts which are likely to be found in any workroom) the volume of air extracted by the fan through a small diameter duct would have to be over 1,600 cubic feet per minute. In Figures 2 and 3 the relation between the ducting and the dust-source is the same, but there is more enclosure. With the dust source enclosed in a hood one foot square (Figure 2) and the same air-speed of 150 feet per minute over the opening, more reliable dust control would be obtained; the volume of air required would be only 150 cubic feet per minute. With still more complete enclosure (as in Figure 3) there would be no risk of dust escaping if the air flow inwards were 150 feet per minute and, with an opening of four inches square, the volume of air required would be only about 17 cubic feet per minute. A typical example of this principle is the familiar pan-mill used for grinding dried clay; if the mill is completely enclosed, apart from the opening necessary for feeding, a reasonable exhaust draught can easily be maintained at the opening; if, however, the sides of the mill are left open, even a very powerful exhaust draught above the pan will have little effect on the dust.

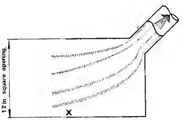
5. Figures 4 and 5 illustrate the importance of the direction, as well as the velocity, of the air flow; the design of the hood should be such that the dust is not carried through the worker's breathing zone as in Figure 4. Figure 5 shows a rear exhaust but for some processes a side draught may be more effective (see Appendix III B).

Volume Required.



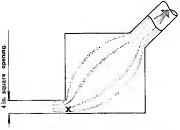
1600 cu. ft/ min.

Fig.1.



150 cu. ft/ min.

Fig. 2.



17 cu. ft/min.

Fig. 3.

Ducting

6. Whatever form of hood is used, the dusty air has usually to pass along some channel or ducting after leaving the hood. Two main points need attention in the design of this ducting:—

(i) air resistance should be kept to a minimum, but the air velocity must be sufficient to transport the dust to the collector without settlement. It has been found that for most pottery dusts, e.g., from towers, fettlers, etc., a minimum air velocity of 1,700 feet per minute is necessary; for heavier dusts, a higher speed would be required (see Appendix II). The cost of running a dust extraction system is largely due to the mechanical power needed to keep the air in motion, and this in turn depends on the resistance which the air encounters in the ducting and collecting system. Air resistance rises very rapidly with increasing speed of air movement, and increases even more rapidly when turbulence sets in. Consequently, one of the most important factors in economical air extraction is to make sure that all ducts are of adequate cross-section for the amount of air they have to carry; in addition, ducting should be so arranged as to give an even flow—there should be no sharp bends, right-angle joints or other features which might cause turbulence;

(ii) the ducting should be of good design and correctly positioned. If ducting situated within a workroom is under pressure from the fan there is a danger of dust particles of respirable size being blown back into the workroom through faulty joints or hair-cracks in the ducting; such points of leakage can be detected by the darts of dust on the outside of the ducting at the joints or cracks. The remedy is to ensure that all ducting in a workroom is under negative pressure, i.e., is placed on the suction side of the fan. Any slight leak in the ducting or casing will then result in air being sucked in, instead of dusty air being blown out through the joints. In any normal system, the air-pressure between the hood and the fan is slightly below atmospheric, and beyond the fan is slightly above atmospheric. It is important, therefore, to keep the fan and all subsequent plant outside any inhabited workroom. If this is not done, the only alternative is to make sure that the fan casing and all ducting under pressure is kept perfectly airtight. This can be achieved by the use of suitable sealing materials, but it throws on the management a heavy responsibility for very high standards of maintenance. The ducting under pressure in the workroom should, in any case, be kept as short as possible.

Collection and disposal of dust

7. After the dusty air has been removed from its point of origin and carried through the ducting by fan, the problem still arises as to what is to be done with it. Regulation 17(6) of the Pottery (Health and Welfare) Special Regulations 1950 contains two requirements: the first is that for most processes the dust should be collected and not simply blown into the outside air, the second is that the dust should not be allowed to escape into the air of any workroom.

There are a number of different types of collectors available which are suitable for collecting pottery dusts.

Types of collectors

8. The characteristics of typical dust collectors have been examined and described in detail by Dr. C. J. Stairmand, D.Sc., M.I.Chem.E., A.Inst.P. A summary of this investigation, in so far as it is applicable to pottery dust, including approximate costs of various dust collecting systems, was given in a paper read to a symposium on Dust Control in the Pottery Industry, held at the headquarters of the British Ceramic Research Association on 8th April 1960, and this was published in the British Ceramic Research Association Special Publication No. 27 in 1961.

9. These dust collectors will stop a large proportion by weight of the dust in the air passing through the extraction system, but even the best of them will not collect completely the finer dust

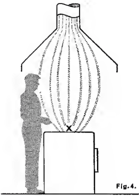


Fig.4.

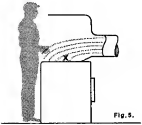


Fig.5.

particles. Regulation 17(7) of the Pottery (Health and Welfare) Special Regulations 1950 therefore requires air from dust extraction plants, even after it has heen passed through a dust collector, to he discharged into the open air and not into the workroom.

Location of dust collectors

10. It is not an uncommon practice, particularly in the case of small units, to install the dust collector inside the shop close to the dust generating equipment or operation. If the exhaust fan is connected to the outlet end of the collector, the unit is under negative pressure and any leakages in the collector will result in drawing the shop air into the unit. With the exhaust fan on the inlet side of the collector, the latter is under positive pressure and if the unit shows any leakage, it will he the very fine, respirahle size of dust that will escape into the shop atmosphere.

11. Attention should he paid to the location of the discharge stacks from the dust collectors. The discharged dust can he hlown from exhaust stacks hack to the shop through open windows and doors. It is very important to use stacks sufficiently high hoth to guard against this possihility and to ensure effective dispersion of any dust of fine particle size passing through the dust collector.

12. These points are illustrated in Figures 6, 7 and 8, which show various arrangements of hood, collector, fan and point of exit from the workroom. The whole of the system after the fan is under pressure greater than atmospheric, and this part is shown shaded. Figure 6 shows a lay-out which is undesirahle in every way. Figure 7 shows the hest form of lay-out with the fan and collector outside the workroom. Figure 8 shows an arrangement that may have to he accepted when it is not possihle to put the collector and fan outside the workroom; the fan should he as near to the outside wall as possihle.

13. As the emptying of dry dust collectors is an extremely dusty operation, it is desirahle from this point of view that they should he situated outside any workroom. If the dust collector is inside a workroom the hest method of emptying the dust container is hy suction into a central vacuum-cleaning system. Dust disposal can create a secondary dust prohlem if not correctly dealt with and the difficulties experienced in some potteries in connection with the disposal of dry dust have resulted in a change-over to wet type collectors. It is not uncommon practice to discharge dry dust from the hopper directly on a lorry. Some of the fine dust which hecomes airhorne during this procedure may he hlown back into the shop and, on a windy day, a cloud of dust will accompany the lorry on its way to the refuse dump. Effective wetting of dry dust, as it leaves a collector or storage hopper, is possihle, hut sometimes difficult. With wet collection the major disposal prohlem is the selection of transport equipment which will eliminate spillage.

Maintenance and testing of dust extraction systems

14. Dust extraction plant has a characteristic in common with many health and safety devices; its value depends on proper maintenance. If it hecomes defective the fact may well he overlooked since it will prohahly not directly affect production, nor will the defect show itself in an ohvious way. There is, therefore, a danger of management and workpeople having a false sense of security when, in fact, the extraction plant is inefficient and there is a serious dust hazard. This danger can he avoided only if management arranges for all their dust extraction plant to he properly maintained and to he regularly tested; an effective system for this should he drawn up.

15. Regulation 17(8) of the Pottery (Health and Welfare) Special Regulations 1950 requires a thorough examination and test of all ventilating plant and dust collecting apparatus by a "competent person" at least once every 14 months. This test is intended to he something over and above the routine maintenance and testing referred to above. It is intended to he an additional check on any system of routine maintenance, analogous of the periodical examination of steam

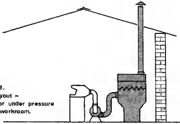


Fig. 6.
Bad layout –
Collector under pressure in the workroom.

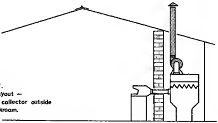


Fig. 7.
Good layout –
Fan and collector outside the workroom.

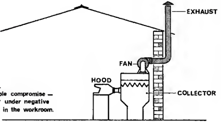


Fig. 8.
Acceptable compromise –
Collector under negative pressure in the workroom.

hoilers and other important or dangerous plant. While the law does not require that this examination and test should be done hy an outside engineer, it is, in fact, good normal practice to entrust the work of testing to some specialised and competent engineer outside the maintenance staff of the firm. The work is often done by insurance engineers or by specialised ventilating engineers.

16. The main aim of the test should he to ensure that the ventilating plant is doing its work efficiently. The fundamental points to he checked during the course of the test, therefore, are:—

(i) The linear air velocity measured under normal working conditions at all exhaust points. As Figures 1, 2 and 3 show, the vital measurement is the air speed at the point of origin of dust or over the frontal plane of the hood; it should not be measured in the " throat " of the duct. The plant can he considered satisfactory only if it gives reasonahle air velocity, with a margin to allow for deterioration, at all extraction points.

(ii) The collectors should he checked to see that they are, in fact, working efficiently and are collecting the dust. The discharge outlets should he above roof level and not near to ventilators.

(iii) The whole plant, and especially any part of it containing air under pressure, should he carefully checked to locate leaks.

Air flow indicator for exhaust hoods

17. In the case of the British Ceramic Research Association towing and fettling hoods, the criterion for determining their effectiveness is the air velocity measured at a certain point inside the hood. It was felt that there was a need for a simple type of air-flow indicator to enahle works inspectors, or operatives working at local exhaust dust control hoods, to detect any marked deterioration in the air-flow through the hood. The Association developed a cheap and simple indicator for this purpose. It consists of a two inch square metal duct, four inches long with a freely swinging vane mounted at one end and a stepped scale marked on the inside face of the duct.

18. Its method of use is simply to hold it horizontally with the open end pressed against the vertical wire-mesh grid which usually covers the entrance to the exhaust duct. The vane will be deflected by the moving air and its position can he compared with the usual position obtained when the exhaust rate is known to be that required hy the design specification for the hood. However, because of the different designs of hood and the consequent variations in air velocity at the grid, two types of indicators are availahle—one with a " heavy " vane for the Association's Flat-ware Towing Hood and one with a lighter vane for their standard hoods designed on the principle of Tunnel Flow, i.e., hoods for hollow-ware and tile fettling. The lighter vane should be suitahle for any other hoods of similar design.

19. The indicator is not a suhstitute for the rotary-vane (windmill type) anemometer generally used for accurate measurement of air movement through exhaust hoods.

20. Information regarding these indicators may be ohtained from the British Ceramic Research Association.

Engineering standards

21. A report prepared for the Committee hy a group of pottery engineers in Stoke-on-Trent is reproduced in Appendix II.

APPENDIX II

Suggested Engineering Standards for Dust Extraction Plants

(prepared by a group of Engineers from the Pottery Industry)

Hoods and exhaust openings

1. All hoods and exhaust openings should be coupled to the main duct by branch mains fitted with a regulating device for the purpose of balancing the system, such regulating devices being suitably sealed and capable of being securely locked in position so that they cannot be moved by operatives or unauthorised persons.

Ducts

2. All ducts should be so proportioned to give a minimum transport air velocity. It has been found that an air velocity of 1,700 feet per minute is required for general pottery ducts—e.g., from towers, fettlers, biscuit brushers, biscuit placers, etc. Higher air velocities may be required for glaze and colour spraying and for dry colours containing heavy metallic oxides, but the actual speed required depends on the specific gravity of the material and on the particle size.

3. All ducts should be constructed of new materials, the interior surfaces being smooth and free from obstructions to avoid lodgment of dust. They may be constructed of metal, plastics, rubber, asbestos compounds, wood or other suitable material but must be rendered air-tight.

4. Round ducts should be used wherever possible. If rectangular ducts have to be used they should be as nearly square in section as possible.

5. Elbows and bends should, whenever possible, have a centre line radius of at least two diameters. If less than this radius is necessary, splitters should be included to guide the air round the bend.

6. Transitions in mains should be tapered. The length of the taper should not be less than five inches for each one-inch change in diameter.

7. Branches should enter mains near the large end of the transition at an angle not exceeding 45°, and preferably 30° or less, in the direction of flow.

8. Branch connections should be staggered; two branches should never enter the main diametrically opposite to each other, and whenever possible branches should enter the main at the top or side and not at the bottom.

9. Clean-out holes, fitted with air-tight covers, should be provided near to each bend or branch duct and at such other positions as may be necessary.

10. Ducts should be supported so that no weight is transferred to slip joints or connections.

11. There should be a minimum clearance of nine inches between low-level ducts and floor, and of four inches between high-level ducts and ceiling, and of four inches between all ducts and walls, except in the case of rectangular ducts, which are fitted close into the corner, providing the gap is suitably sealed to prevent ingress of dust from the general atmosphere.

12. All pressure ducts within the workroom should be as short as possible with all joints sealed air-tight with a suitable sealing compound.

(*a*) *Metal ducts*

13. Ducts should be of not less than 20 s.w.g. galvanised sheet or of black sheet galvanised after fabrication.

14. All longitudinal seams or joints should be air-tight. They may be seamed and rolled along the whole length of the duct or may be riveted, or spot-welded, on three inch centres or less, and rendered air-tight by soldering or by other suitable sealing materials.

15. Bends should be of not less than 18 s.w.g. galvanised sheet.

16. All right-angle bends or elbows should be made of not less than five pieces of sections, and when greater than six inches diameter should be made of not less than seven pieces. Obtuse bends should be pieced proportionately.

17. All slip joints should be so constructed that the outlet of one pipe enters the inlet of the next in the direction of air flow, and the length of the slip between sections should not be less than one-sixth of the diameter of the pipe.

18. The maximum supporting interval for horizontal ducts should be 12 feet for ducts eight inches or smaller in diameter, and 30 feet for larger ducts.

(b) Non-metallic ducts

19. Ducts may be of other suitable material if desired—e.g., rubber, plastics, asbestos compounds, cement compositions, etc.

20. All non-metallic ducts should be rendered air-tight at all joints with a suitable sealing material.

21. The maximum supporting interval for non-metallic ducts should be eight feet for ducts eight inches diameter or smaller, and 12 feet for larger diameter ducts.

Dust collectors

22. Dust collectors may be of the wet or dry type. For each type there is a minimum particle size below which its collecting efficiency is too low to be of practical value. The minimum particle size groups for collectors of interest to the ceramic industries are given in the following table:—

Type	Minimum Particle Size Microns
Settling Chamber	100–200
Inertial Collector	50–200
Cyclone, Large Diameter	40–60
Cyclone, Small Diameter	10–30
Fabric Filter	0.5–2.0
Wet Collector	1.0–2.0
Electrostatic Precipitator	0.001–1.0

Frequently the air-cleaning equipment will consist of more than one type of collector in series. The primary collector is usually a settling chamber or cyclone, and the secondary collector a fabric or wet filter. The equipment must, however, be designed for the particular duty and for the conditions in which it is to work.

23. Dust collectors should be of sufficient capacity not to require shut-down for emptying during normal working hours.

24. Fabric filters should be designed with sufficient filtration area that the volume of air flowing through does not fall by more than 10% between bag-shaking, and the lower volume should be sufficient to prevent dust escaping from the process to the general atmosphere of the workroom. A velocity of three feet per minute through the filter-cloth will usually achieve this for normal dust concentrations, but for heavy concentrations the velocity may have to be reduced.

25. Bag-shaking should only take place during breaks, or after normal working hours.

26. Removal of collected dust should only take place during breaks or after normal working hours. If possible, removal should be by discharging the dust into impermeable bags or into water, but if this is not possible the operative removing the dust should be provided with a suitable respirator.

27. Dry collectors should only be cleaned or emptied with the fan motor stopped. A main damper may be included in the main inlet duct, near to the collector, to isolate the main from the collector during cleaning or emptying.

28. Fans should be of a design and capacity to give the requisite air flow under all conditions likely to be encountered.

29. Where possible the exhaust fan should be situated on the discharge or clean side of the collector.

30. The discharge from every exhaust system should be to the outside atmosphere, with the point of discharge above adjacent roof-ridge or parapet level, in such a position that it cannot be recirculated into any workroom, and should comply with local bye-laws. If vertically upwards, discharge pipes should be fitted with a weather cowl.

Inspection and test

31. Inspections should be made at least quarterly.

32. Hoods should be inspected to see that they have not been damaged or interfered with.

33. The air velocity through hoods should be checked at a standard position.

34. The static pressure at a fixed point in the duct should be checked.

35. The fan and motor should be checked for speed, lubrication and general cleanliness. The drive from fan to motor should also be inspected.

Ducts

36. All ducts should be inspected for build-up of dust and for tightness of joints. Any leakage at joints should be rectified at once.

37. Dampers should be checked to see that they are not obstructed, that they are adequately sealed, and that they are securely locked, and, if necessary, re-adjusted to balance the system.

38. Fabric filters should be inspected to check the condition of the cloths and the operation of the rapping device. Damaged or deranged cloths should be removed.

Cyclones

39. Cyclones should be inspected for build-up of dust in the interior, and the discharge valve should be inspected for air tightness.

Wet collectors

40. Wet collectors should be inspected for water level, correct operation of water-level control valve, sludge-discharge valve, water-supply and corrosion inside the collector.

41. In spray cleaners the spray-jets, water-supply and sludge discharge should be examined for correct functioning.

APPENDIX III

List of appliances for the control of dust designed by the British Ceramic Research Association

A. Towing hood for flat-ware.

B. Fettling hood for hollow-ware.

C. Dust control for Malkin semi-automatic cup-turning machine.

D. Fettling hood for tiles.

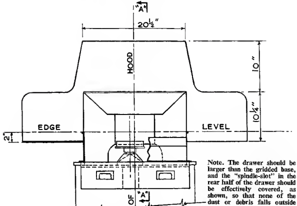
E. Combined safety guard and exhausted die-enclosure for dust control on friction screw tile press.

F. Dust control arrangement for Collingham and Owen automatic tile press (developed in conjunction with the press manufacturers).

G. Fettling hood (combined blowing and exhaust fettling hood) for sanitary white ware.

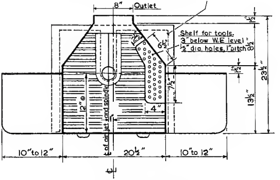
APPENDIX III A

Arrangement of Towing Hood for Flat-ware

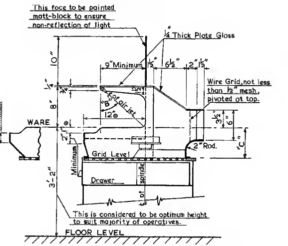


Note. The drawer should be larger than the gridded base, and the "spindle-slot" in the rear half of the drawer should be effectively covered, as shown, so that none of the dust or debris falls outside the drawer.

Front view with part of 'Front-Plate' cut away



Plan at Ware-Edge level



Arrangement when 'Front-Plate' has to slope back, to meet existing grids

SECTION 'AA'

IMPORTANT Dimensions marked ⊕ are critical if maximum dust control is to be obtained and should not be varied without consulting B.Ceram.R.A.

'Front-Plate' must not be removable and all joints sbould be dust tigbt.

Cleaning Air-Jet. Jet-Angle 'B' sbould not be less than 35°.

For continuous Jets is is recommended that the following conditions of air-pressure and nozzle diameter should not be exceeded. 10 p.s.i. at $\frac{3}{64}$" dia. nozzle. 15 p.s.i. at $\frac{1}{32}$" dia. nozzle.

Gridded Base. Bars forming grids should be arranged to give maximum open area and should have tops rounded or ridged—not flat.

Grid level should be as high as possible, but not less than 3" below Ware-Edge level. (Experimental hoods tested with dimension 'C', 6" to 7".)

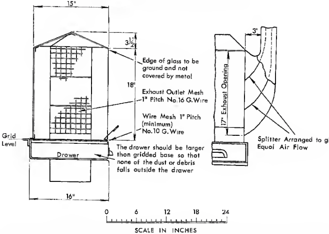
Side-Platforms. Where a side-platform is to be used for direct setting of ware on sand, it should be perforated and a receptacle for the excess sand should be provided under the platform.

The dimensions of this hood are such that it will accommodate the great majority of flat-ware. Certain exceptional sizes of ware, or methods of working such as the turning over of ware inside the hood, may need a larger size of hood. Deeply embossed or ornamented ware may need special arrangement of the cleaning air-jet, and in either case the B.Ceram.R.A. should be consulted.

Air-Flow. The recommended minimum horizontal air-flow towards the outlet, measured at 2" above the centre of the ware, without the air-jet in operation, is 300 ft./min. The volume of air to obtain this flow is approx. 600 cu. ft./min.

APPENDIX III B

Arrangement of Fettling Hood for Hollow-ware



Air-Flow. The minimum horizontal air-flow towards the exhaust opening to be 150 feet per minute, measured at the intersection of the centre lines of the hood, 10 in. above the grid, at all times when fettling is being done. (The volume of air to obtain this flow is approx. 450 cu. ft./min.)

Grid Level. To suit majority of operatives, grid level should not be higher than 31 in. above floor level.

Position of Exhaust. The hood is shown for connection to under-bench ducting. When overhead ducting is preferred the outlet should be modified as shown.

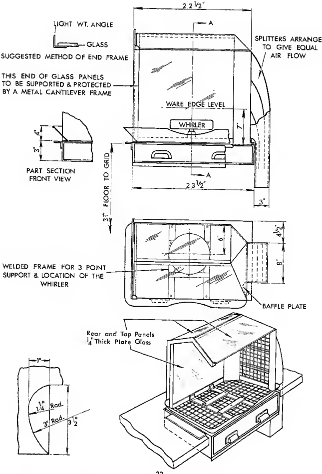
Rotation of Ware during Fettling. For this purpose a portable hand operated whirler (to suit size of ware to be fettled) should be provided, for location within the hood as indicated, such that the ware edge level is about 7 in. above grid level. In no case should the centre of the whirler be nearer to the operative than the centre line of the hood.

Sponging of Ware within the Hood. Although this is not essential it can give some production advantages. A suitable position for the water container would be at the right-hand side of the operative with its rim about 2 in. above grid level.

Constructional Details. To be decided by supplier. But sizes given are important and should not be varied without consulting the B.Ceram.R.A.

If a valve is fitted in the exhaust ducting it should not be adjustable by the operative and should be located sufficiently remote from the splitters to avoid disturbing the equal air-flow conditions in each ection of the duct intake.

Materials. Hood constructed of galvanized sheet metal except where shown otherwise.


2 2 1/2"
A
LIGHT WT. ANGLE
GLASS
SUGGESTED METHOD OF END FRAME
SPLITTERS ARRANGED TO GIVE EQUAL AIR FLOW
THIS END OF GLASS PANELS TO BE SUPPORTED & PROTECTED BY A METAL CANTILEVER FRAME
WARE EDGE LEVEL
WHIRLER
7"
4"
3"
PART SECTION FRONT VIEW
31" FLOOR TO GRID
2 3 1/2"
3"
4 1/2"
6"
8"
WELDED FRAME FOR 3 POINT SUPPORT & LOCATION OF THE WHIRLER
BAFFLE PLATE
Rear and Top Panels 1/4" Thick Plate Glass
1"
1 1/4" Rad.
3" Rad.
3 1/2"

APPENDIX III C

The British Ceramic Research Association

Dust control for Malkin Semi-Automatic Cup-turning Machine

A new dust control arrangement has been developed by the Research Association for the cup-turning machine manufactured by Messrs. F. Malkin and Co. Ltd. Three machines, each in a different factory has been equipped with this arrangement. One of these has been in continuous production use for the last 17 months, one for three months and one has had intermittent use during the last six months. All have given satisfactory service.

Description. In the new arrangement the cutting-tool region of the machine has been almost completely enclosed and subject to exhaust ventilation. Figure 1 shows the enclosure A with the top and part of the sides B of the enclosure raised to give access for tool adjustment. The base of the enclosure is now formed by a horizontal shaker conveyor (a single plate) which has an oscillating movement of $\frac{1}{4}''$, 96 times per minute, imported by a cam mounted on an existing shaft. The clay-scrap comes off the right hand end of the conveyor and slides down the chute C into the mobile scrap-bin D. The top of the scrap bin is covered by a large horizontal flange mounted on the bottom of the chute. This reduces the area through which fine dust could escape and therefore reduces the required minimum exhaust volume.

In Figure 2 the machine is shown ready for use and the tool-cover E has been pulled into its forward position. This action starts the machine cutting-cycle and the cover is now in a position to contain all clay-scraps projected from the cutting-tools and to blank-off part of the frontal opening thus making it easier to prevent the escape of fine airborne dust. As soon as the cutting cycle is complete the tool-cover flirts back into its rear position.

The minimum exhaust volume required is 270 cu. ft./min.

Testing. The three arrangements have been tested for air-flow, observations and cine-photography have been carried out under the special lighting conditions. Dust samples were taken in the operatives' breathing zone, in the surrounding general atmosphere and also at a position in close proximity to the opening in the top of the enclosure. The results of these tests, at the minimum exhaust volume, show that the fine dust produced by the turning operation is under efficient control. In addition the clay-scrap is collected for easy disposal.

Fig. 1

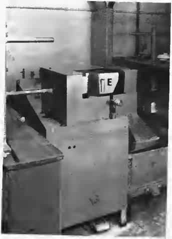
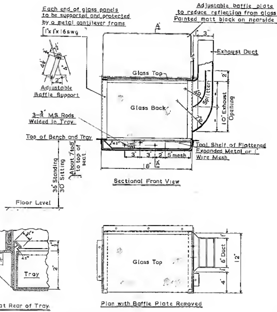


Fig. 2

APPENDIX III D

Arrangement of Fettling Hood for Tiles



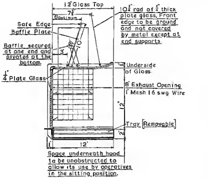
Position of Exhaust. The hood is shown for connection to overhead ducting. When other positions are preferred the outlet duct should be constructed so as to obtain an equal distribution of air flow into the exhaust opening.

Materials. Hood constructed of galvanized sheet metal except where shown otherwise.

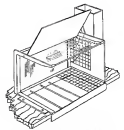
Constructional Details. To be decided by supplier but sizes are important and should not be varied without consulting the B.Ceram.R.A.

If a valve is fitted in the exhaust ducting it should not be adjustable by the operative and should be located sufficiently remote from the splitter (4 in. min. in duct shown) to avoid disturbing the equal air flow conditions in each section of the duct intake.

Arrangement of Fettling Hood for Tiles



Section A-A



Isometric View of Hood

It is advisable to allow about 12" clear bench-space at the LH end of hood for the fettled and unfettled stocks of tiles

Air-Flow. The minimum horizontal air-flow towards the exhaust opening to be 200 ft./min., measured 6 in. above tray top at the intersection of the centre lines of the hood, at all times when fettling is being done (the volume of air to obtain this flow is approx. 300 cu. ft./min.).

Height of Tray Top above Floor Level

1. *For operatives standing and occasionally sitting.* To suit the majority of operatives the tray top should not be higher than 36 in. above floor level. For very short operatives a standing board should be provided so that the operative's chin will be above the level of the front edge of the glass top. If the hood is to be used by operatives in the sitting position a suitable seat and footrest should be provided.

2. *For operatives sitting only.* The tray top should be about 30 in. above floor level and a suitable seat and footrest should be provided.

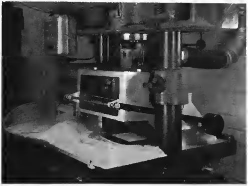
APPENDIX III E

Combined Safety Guard and Exhausted Die-enclosure for Dust Control on Friction Screw Tile Press

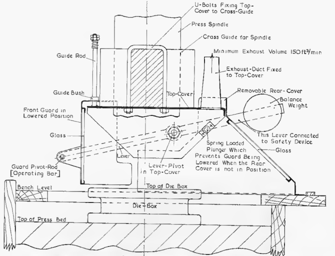
Air-Flow. The minimum exhaust volume while the guard is in the raised position to be 150 cu. ft./min. (With most dies in normal use this is sufficient to give an air-movement within the enclosure, on the centre-line of the press-pillars, of at least 175 ft./min. (average) with the guard in the raised position.) Exhausting must be continuous at all times when the press is in use.

Constructional Details. Details are given on DRG. No. E 008/101B/26 and 27 which can be obtained from the British Ceramic Research Association.

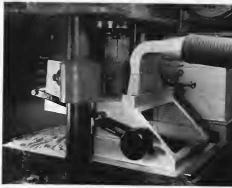
Safety Arrangements. The movable guard may be connected to any suitable safety device. The B.Ceram.R.A. has developed suitable devices for Gosling & Gatensbury, Jesshope, and Boulton Presses—drawings are available.



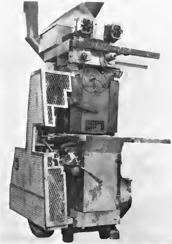
Front view of enclosure with guard in normal position



Section of Enclosure. Top Die Not Shown.

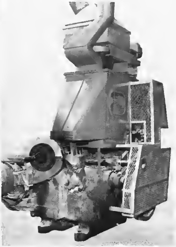


Rear view of enclosure



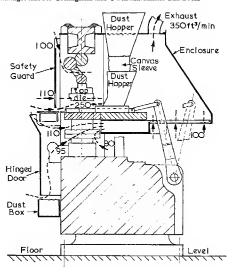
Front of press with hinged door and safety guard in normal closed position

Rear showing enclosure



APPENDIX III F

Dust Control Arrangement for Collingham and Owen Automatic Tile Press



Section of enclosure
(Air speed in ft./min. at minimum exhaust volume)

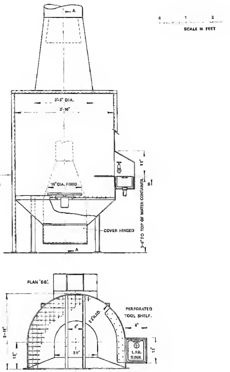
Air-Flow. The minimum exhaust volume to be 350 cu. ft./min. at all times when the press is in use.

Position of Exhaust. The enclosure is shown for connection to overhead ducting. Under-floor ducting may be connected into the base of the enclosure.

Constructional Details. Detailed drawings can be obtained from the B.Ceram.R.A.

Official Recognition. The Joint Standing Committee for the Pottery Industry recognizes this arrangement as providing means of practical compliance with the requirements of Regulation 17 (1) (ix) of the Pottery (Health & Welfare) Special Regulations for Automatic Tile Presses. This recognition is subject to proper installation, maintenance, and adherence to the specified air requirements and is without prejudice to further developments or improvements which may be found necessary in consultation with the B.Ceram.R.A. (November, 1961).

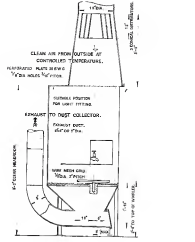
APPENDIX III G



APPENDIX III G

Clean Air from Outside at Controlled Temperature

Inlet air to be evenly distributed before entering conical distributors. Nearest bend and damper to be as remote as possible: use guide vanes where necessary. Where headroom is severely restricted consult British Ceramic Research Association.



SECTION 'A A'

The Joint Standing Committee for the Pottery Industry

Recognises this hood as providing means of practical compliance with the requirements of Regulation 17(1) (vii) of the Pottery (Health and Welfare) Special Regulations for the fettling of Sanitary Whiteware. This recognition is subject to proper installation, maintenance, and adherence to the specified air requirements and is without prejudice to further developments or improvements which may be found necessary in consultation with the B.Ceram.R.A. (September 1961).

Blowing. The jet from the 2 ft. 3 in. dia. inlet to be evenly distributed so as to give an average velocity of 120 - 130 ft./min. measured 12 in. below the perforated plate. The volume of air to obtain this flow is about 500 cu. ft./min.

Exhausting. The minimum average velocity at grid level to be 100 ft./min. measured whilst the blower is operating. The volume of air to obtain this flow is about 800 cu. ft./min.

Sponging. The hood is shown fitted with a sink and piped water supply but a removable water container may be substituted providing its top edge is positioned as shown.

Constructional Details. To be decided by supplier but sizes are important and should not be varied without consulting the B Ceram.R.A.

Materials. Hood constructed of galvanized sheet metal except where shown otherwise.

Lighting. Interior of hood to be brightly illuminated. (A suitable position for a light-fitting is indicated.)

APPENDIX IV

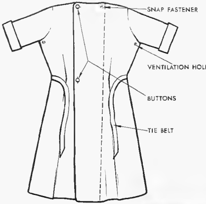
PROTECTIVE CLOTHING

Illustrations of Suitable Overalls for use in the Pottery Industry

(a) Suitable Design for Women

Front view

SLEEVES SHOULD BE LONG ENOUGH TO COVER GARMENTS WORN UNDERNEATH



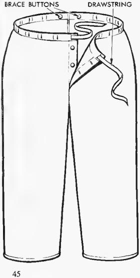
Back View

APPENDIX IV

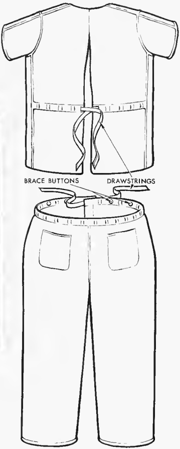
PROTECTIVE CLOTHING

(b) Suitable Design for Men

Front View



Back View



APPEND

APPENDIX V

Initial and Periodical Examinations

Specified Processes

(Schedule to Silicosis and Asbestosis (Medical Arrangements) Scheme 1931 (as amended), as applied by the Industrial Injuries (Prescribed Diseases) Regulations 1959 (regulations 41 and 42)).

(i) Millmen engaged in flint milling and all workers engaged in the preparatory processes of handling the calcined flints from the kilns and the crushing of calcined flints, or the crushing or grinding of silica rock or dried quartzose sand;

*(ii) in the manufacture of china, if powdered flint or powdered silica is used for the placing of ware for the biscuit firing; biscuit placers and biscuit oddmen, including male assistants and apprentices and biscuit warehouse workers;

(iii) in the manufacture of general earthenware: male dish makers, male plate makers, male casters, male hollow-ware pressers and all other males including assistants and apprentices employed in processes carried on in potters' shops;

(iv) in the manufacture of sanitary earthenware; casters and pressers, including male assistants and apprentices;

*(v) in the manufacture of electric earthenware; slip-house workers (other than workers employed exclusively in such occupation in a room in which no other occupation included in the schedule is carried on); and dust grinders and dust carriers and any persons working in the same room in which such occupations are carried on;

*(vi) in the manufacture of earthenware tiles; slip-house workers (other than workers employed exclusively in such occupations in a room in which no other occupation included in the schedule is carried on); and dust grinders and dust carriers and any persons working in the same room in which such occupations are carried on, pressers including assistants and apprentices and fettlers;

*(vii) polishers and grinders, if powdered flint or powdered silica is used.

* Certain of the specified processes are now obsolete by virtue of the provisions of the Pottery (Health) Special Regulations 1947 and the Pottery (Health and Welfare) Special Regulations 1950, i.e.—
(ii) and (vii) The 1947 Regulations prohibited the use of powdered flint or silica for the placing of the china biscuit and for polishing and grinding.
(v) and (vi) The 1950 Regulations required every slip-house to be effectively separated from the other scheduled processes so that all slip-house workers are virtually excluded from the schedule by the proviso.

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Dust Control in Potteries

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CORRECTION

The following title should be inserted at the top of page 30

APPENDIX IIIB

Arrangement of Fettling Hood for Hollow-ware

Department of Employment and Productivity
February 1969

LONDON: HER MAJESTY'S STATIONERY OFFICE
